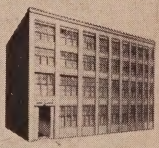
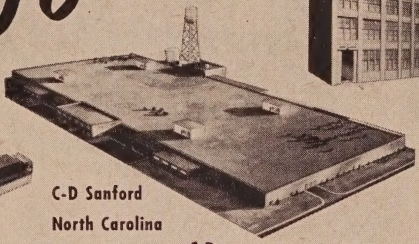
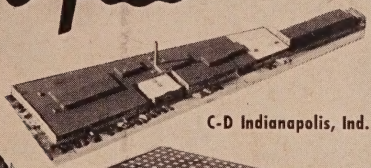
the CORNELL-DUBILIER Capacitor

The Radiart Corp.
Cleveland, Ohio
4 Plants



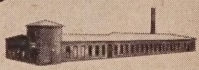


C-D Sanford
North Carolina



C-D Indianapolis, Ind.

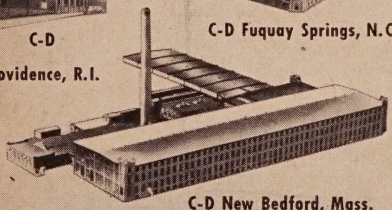
C-D
Hope Valley, R.I.



C-D South Plainfield, N.J.

C-D
Providence, R.I.

C-D Fuquay Springs, N.C.



C-D New Bedford, Mass.

C-D Worcester, Mass.

C-D Cambridge, Mass.

Vol. 20 MARCH, 1955 No. 3

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The smaller the capacitor the more you will appreciate C-D's built-in extras!

Cornell-Dubilier has proved that you don't have to compromise with quality for size in a capacitor. You will find that regardless of how small a C-D capacitor may be, it still retains that extra margin of safety required in a high quality miniaturized unit. *See your classified telephone directory for nearest C-D jobber.*

IF IT CAN BE MADE SMALLER . . . C-D DOES IT!

THERE ARE MORE C-D CAPACITORS IN USE TODAY THAN ANY OTHER MAKE

CORNELL DUBILIER Capacitors

PLANTS IN SOUTH PLAINFIELD, N. J.; NEW BEDFORD, WORCESTER AND CAMBRIDGE, MASS.; PROVIDENCE AND HOPE VALLEY, R. I. INDIANAPOLIS, IND.; FUQUAY SPRINGS AND SANFORD, N. C.; AND SUBSIDIARY, THE RADIART CORPORATION, CLEVELAND, OHIO

MICE ARE MOVING MOUNTAINS

THE HISTORY AND PROMISE OF PRINTED CIRCUITRY

by HUBERT L. SHORTT*

Several weeks ago a friend of mine wrote, "Most certainly we are at the dawn of a revolution within this industry and within the many industries that it serves." We had just returned from a symposium on Printed Circuits that had attracted more than one thousand engineers, scientists and technicians from all over the country. The companies represented by these men read like a Blue Book of American industry, and they had gathered to discuss, to learn and to teach what was going on in the relatively new art of printing electrical circuits.

In more than one sense, this huge symposium represented a fruition of the pioneering efforts of two men — Dr. Paul Eisler and Dr. Cledo Brunetti — who breathed life, during the War years, into the possibility of replacing outmoded, costly complicated wiring boards with a relatively simple, extremely economical method of turning them out in mass production by utilizing the graphic arts. And it occurred to me that maybe my friend's reflection was perhaps the understatement of the year . . . that we are now well advanced into this revolution in industry — this new concept where miniaturization and automation are, at once, the demands and the goals, the slaves and the masters.

Printing circuits by the now universally accepted etched foil process is, of course, but one of the little mice that move the gargantuan industrial mountain. But it is a key mouse that has made possible much of our progress to date and that promises so much for our industrial future.

Its conception and first application goes back less than fifteen years and the path of its development, perfection and general application, has until recent time, been strewn with obstacles of disbelief, distrust and an unwillingness to accept the new because of vested interests in the old.

The development of this process was begun in 1941 by Dr. Paul Eisler, Research Director of Technograph and the first step taken was to evaluate the various methods by which conductive patterns on an insulating base could be produced.

The methods submitted to test included such as the forming of conductors by printing with inks composed of metal in powdered form, the use of colloidal inks, the electrodeposition of conductive patterns upon various kinds of insulators, the printing or stencilling of metal powder with subjection to heat treatment to secure fusion into homogeneous structures, and several other possible or theoretically-likely means.

As evaluation progressed it became ever more clear that the use of metal foil bonded to an insulating base, and its subsequent conversion into the desired pattern by means of printing and etching, produced circuits possessing not only the best electrical behavior, but also the essential virtues of adequate mechanical strength. This method, moreover, allowed the use of different metals in association with the widest possible choice of insulating materials.

When, after comparative testing, the superiority of this method had been established all efforts were concentrated upon developing the foil

*Pres. Technograph Printed Electronics, Inc., Patentee and Licensor.

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technique. This led in turn to the production of entirely new kinds of circuit, in particular those types now referred to as foldable circuits — that is to say, circuits where the conductive pattern is formed on very flexible insulators such as polyethylene and other plastic films, impregnated paper or cloth, woven glass fibre, synthetic rubber in thin sheet form, silicone film and other materials. Such insulators enable a circuit, when once the required pattern has been etched upon it while in a flat state, to be folded up, rolled or bent into a three dimensional form.

The Technograph System thus allows not only the choice of metal and insulator, but also whether the circuit shall be rigid or foldable in form, whether the bonding cement shall be of thermo-setting or thermo-plastic type, whether the circuit shall be suited to working conditions of high or low temperature, and other important technical aspects which can be determined at the design stage.

The entrance of Cornell-Dubilier into the printed circuit field is a very natural and logical move, since the etched foil technique is ideally suited for the production of many types of components. For example a printed circuit wiring board is essentially a component of an electric or electronic device. It may also be considered as a "prefabricated" wiring network. In other words, what was previously considered as part of the assembly operation, that is hand-wiring, has now been converted into a basic component in the form of a wiring board in the same sense that a capacitor, resistor, transformer, etc., are considered as components. Furthermore, it is possible to extend the scope of this new component to include not only the wiring array, but also certain other components which can be made integral to the wiring pattern; for example, inductors, small capacitors, certain value of resistors, switch contacts, and tuning networks.

When the printed wiring board component was first conceived, it was evaluated on the basis of simply replacing wires in a more uniform and reliable manner. While it was recognized that this represented substantial gain, it did not warrant all-out conversion from conventional methods to the use of prefabricated wiring boards. As time progressed it soon became evident that the use of a prefabricated wiring panel could accomplish many other things which had heretofore been overlooked.

Rather than review the historical background of these developments, it would be more helpful simply to enumerate the production and performance gains made possible by converting from conventional assembly techniques to the more advanced printed board assembly.

1. Reduced engineering and design time. The original black and white

drawing is converted by photographic means to an actual circuit pattern and assembly support. Hence, elaborate mechanical drawings in great detail are no longer required.

2. Tooling errors are greatly reduced or entirely eliminated since it is no longer necessary for mechanics to interpret these drawings through the use of machinery. The conversion from a black and white print to the actual product is direct and positive.

3. It is theoretically impossible to have the usual type of production or wiring errors. Everything is on a "go" and "no go" basis.

4. Printing wiring boards eliminate the necessity of hand or point-to-point soldering. By placing components on one side of a panel board and leaving substantially all the wiring on the opposite side, soldering of all connections is readily accomplished in a matter of seconds. Imagine soldering 300 to 400 connections in five seconds!

5. When new products are designed to take full advantage of printed wiring board techniques, it is possible to both improve the performance of the particular instrument and to add many features not economically possible by conventional technique.

6. Overall production costs are greatly reduced by elimination of costly inspection procedures to prevent errors in placement of wires, components, and bad soldering connections. Likewise, production supervision is substantially reduced because the chance of error on the part of an untrained operator is practically eliminated, especially if components have preformed terminations.

7. The extremely low tool cost, i.e., a black and white drawing and some form of printing plate, contributes to the ease of design change and modification. Conductors are added or removed by means of a drawing stylus. Moreover, these tools can be stored with the greatest of ease and reactivated on a moment's notice.

8. This new component in the form of a printed circuit wiring board, in effect, contains its own instruction sheet. As a result, production lines can be activated in a very short period of time, using relatively untrained operators. It is analagous to a jigsaw puzzle, i.e., the component will only fit on the wiring board in the position originally designed to accept each component. By placing part number designations on the printed wiring board at the time of its manufacture, and at no extra cost, printed wiring board assembles can literally be made without prior instructions.

9. Perhaps one of the greatest contributions to the printed wiring board technique of assembling electronic apparatus is that it permits, for the first time, mechanized assembly. Machines and equipment are already on the market and many others are being designed to automatically assemble such items as radio receivers, television receivers and all forms of electronic apparatus, without the aid of manual operators.

10. All the advantages so far enumerated for the printed circuit board type of construction mean lower cost of product through both the elimination of direct labor and the reduction of indirect labor.

Much has been written on specific applications of printed wiring board techniques, showing how many types of products have been converted from conventional wiring methods to printed circuit board construction employing dip soldering.

Those desiring to study the written literature can secure detailed information by writing the Engineering

Department, Printed Circuit Division, Cornell-Dubilier Electric Corporation, South Plainfield, N. J.

The prefabricated wiring board using etched foil techniques is the basis of all mechanized assembly of electronic apparatus. In a certain sense it may be considered as a reference point to which all other components are referred, and hence is the key to automatic assembly. It is the general consensus of opinion of those who have already applied printed circuit techniques for the assembly of electronic apparatus, that within the next few years hand-wired apparatus will disappear completely.

Although the term "printed wiring board," as it is used today, refers to an item which I have described at length in the preceding paragraphs, it should not be gleaned that the etched foil technique is mainly used for the production of such wiring boards. Many components produced by wire methods are being replaced today by the etched foil concept. In addition, many new types of components, which could not be produced by mechanical or wire winding procedures, are appearing in ever-increasing numbers. For example, many new types of strain gauges, deicing mats, temperature sensing elements, heating mats and high wattage resistors have already been resolved, and are in production. Some of the new things to come are high ohmage resistors and capacitors.

A few of the components which were previously manufactured by mechanical methods and have either been replaced completely or to a very large degree by printed and etched foil techniques are:

(1) Rotary Switch plates

(2) Microwave resonators and wave guides

(3) Complex code disks for computors

(4) Filter networks

(5) Relay switching contact assemblies

(6) R.F. and I.F. Transformers

(7) Many varieties of commutators both rotary and co-planer types.

In the early stages of the development of the etched foil technique, suitable materials were not available for all applications. Today copper laminates are being manufactured from almost every type of plastic including resins such as Melamine, Epoxy, Silicone and Teflon. These base laminates include not only those where paper is the base material to which resin is applied, but also many other fibres including glass. Each particular resin laminate has its place in the manufacture of wiring boards and components. The choice of an epoxy resin laminate in favor of a phenol or bakelite XXXP laminate is a matter of cost versus electrical and temperature requirements.

The future holds as many, if not more, possibilities for the application of the etched foil process of producing printed circuits. And the demand — yes, the need — for printed circuits will increase a thousandfold. If industry continues its trend toward complete automation — and there is every indication that it will — then mice will continue to move mountains in this new industrial revolution . . . and our indebtedness to those whose imagination and knowledge and persistance made it possible will grow with our acceptance of the fruits of their capabilities and of their genius.

COIL DATA

SUPERMODULATED PHONE TRANSMITTER DESCRIBED IN THE OCTOBER, 1953, ISSUE OF THE C-D CAPACITOR

AT 80 METERS

1. Use 160-meter crystal.
2. Plug 160-meter coil in L_1.
3. Plug 80-meter coil in L_2.
4. Plug 80-meter coil in L_3.
5. Plug 80-meter coil in L_4.

AT 40 METERS

1. Use 80-meter crystal.
2. Plug 80-meter coil in L_1.
3. Plug 40-meter coil in L_2.
4. Plug 40-meter coil in L_3.
5. Plug 40-meter coil in L_4.

COIL SPECIFICATIONS

COIL L_1:

80 Meters — 57 turns No. 20 enamelled wire closewound on 1½"-diameter form. Tap 14th turn from B-plus end.

160 Meters — 97 turns No. 24 enamelled wire on 2" diameter form. Space to winding length of 2½ inches. Tap 24th turn from B-plus end.

COIL L_2:

80 Meters — 57 turns No. 20 enamelled wire closewound on 1½"-diameter form. Tap 9th turn from B-plus end.

40 Meters — 31 turns No. 20 enamelled wire on 1"-diameter form. Space to winding length of 1 inch. Tap 5th turn from B-plus end.

COIL L_3:

80 Meters — 55 turns No. 20 enamelled wire closewound on 1½"-diameter form. Tap 31st turn from B-plus end.

40 Meters — 30 turns No. 20 enamelled wire on 1"-diameter form. Space to winding length of 1 inch. Tap 4½ turns from B-plus end.

COIL L_4:

80 Meters — 42 turns No. 18 enamelled wire closewound on 1½"-diameter form. Center tap. Winding length 1¾ inch.

40 Meters — 23 turns No. 18 enamelled wire on 1½"-diameter form, spaced to winding length of 1¾ inch. Center tap.

COIL L_5:

80 Meters — 6 turns No. 18 enamelled wire closewound on 2"-diameter form. Tap every 2nd turn for matching to antenna transmission line. Place over center of L_4, so that L_4 and L_5 are coaxial.

40 Meters — 11 turns No. 18 enamelled wire closewound on 2"-diameter form. Tap every 2nd turn for matching to antenna transmission line. Mount over L_4 so that L_4 and L_5 are coaxial.

C-D AIRPLANE FIRST WITH "WEATHER-EYE" RADAR FOR SAFER AND SMOOTHER FLYING

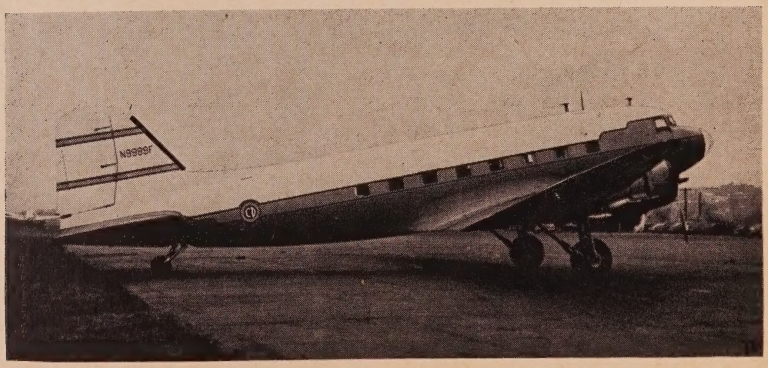
Did you ever hear a pretty airline hostess say, sweetly, "Please fasten your seat belts. We may be coming into a little weather"? Then, you probably know how that "little weather" can suddenly change a nice peaceful ride into a jolting, jarring nightmare. And the chances are you wondered if the pilot didn't pick the roughest route he could find just to knock you around a bit.

Actually you know he didn't, but you still wondered why he couldn't have flown around the storm.

The truth of the matter is the pilot would have done just that if he were able to. But, if you were flying at night or "in the soup," he couldn't see where the rough spots were any more than you could.

You'll be happy to learn that these rough flights will soon be a thing of the past. In fact, for passengers on C-D's private DC-3 transport plane, they have already been eliminated. For C-D has made another "famous first" — the very first commercial or private plane installation of a newly developed radar device for detecting weather conditions in flight.

This new radar "weather-eye" enables the pilot to spot rough weather as far as 150 miles ahead and shows



The Cornell-Dubilier DC-3. Behind the plastic nose is housed the antenna for the new radar installation.

Here's how a storm looks on the radar screen. The circles show the distance from the plane. At the 150 mile range each circle represents 25 miles, at 50 mile range circles are 10 miles, at 20 mile range circles are 5 miles.

him where the "holes" are so that he can avoid the turbulent or "bumpy" areas. Thus flights around storm areas are now possible with greatly improved safety and passenger comfort.

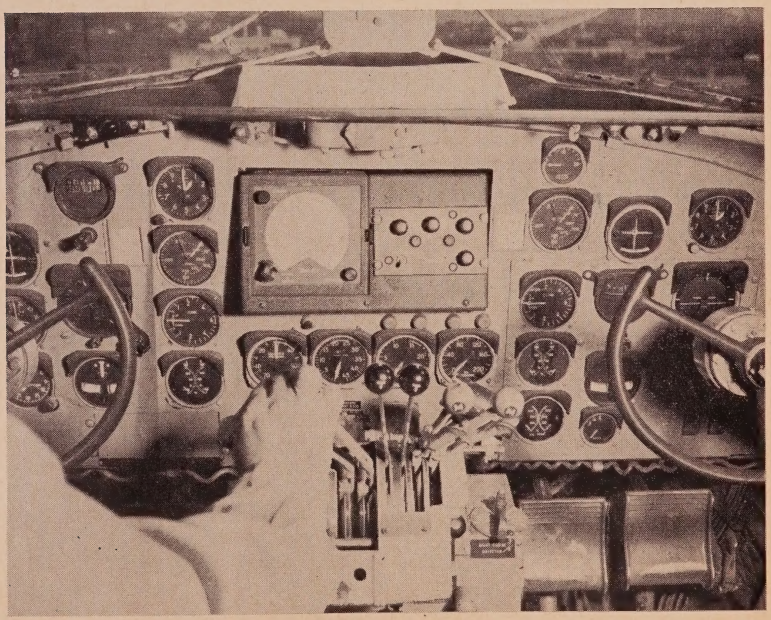
Here's how it operates. As you know, radar operates on a principle of reflecting electrical impulses. This new radar system, with a rotary antenna mounted in the nose of the plane, sends out a pencil shaped beam to scan an area of more than 90 degrees on either side of the aircraft. The beam bounces off objects in its path and is reflected back to the receiving antenna. These reflections show up as "pips" on a scope, located in the cockpit of the plane.

The operation of weather radar depends on the fact that water particles, either suspended in a cloud or as falling rain, will reflect the radar beam at a strength comparable to the concentration or density of the moisture. In other words, thin rainfall will show up lightly on the screen, whereas a heavy rain will be seen on the screen as a very bright spot.

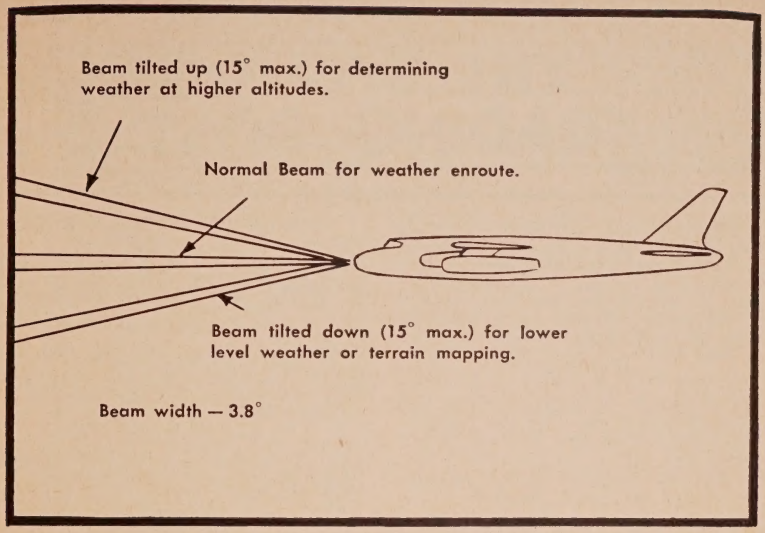
Although rain itself is not much of a hindrance to all-weather flight, meteorological studies show that turbulence increases and decreases in direct proportion to the variation of precipitation within an area.

Thus, the pilot, with a minimum amount of training in recognizing the "pips" on the screen, can judge at a glance where the rough spots are in a storm area and "pick" his way around them.

Previous to the development of this new system, an air-borne radar installation usually required an additional crewman to operate it. The "weather-eye" radar can be controlled entirely by the pilot from his regular cockpit position. All controls are arranged on a simple control panel located right next to the indicator screen. All the pilot has to do is turn on the unit and select his scanning distance, and he's in business. There are three ranges of scanning distances available — from 0 to 20 miles, 0 to 50 miles and 0 to 150 miles. If he wants, the pilot can even tilt the beam to observe weather con-



This view taken in the cockpit of the C-D plane shows the radar controls and indicator screen right on the instrument panel — within easy reach of the pilot.

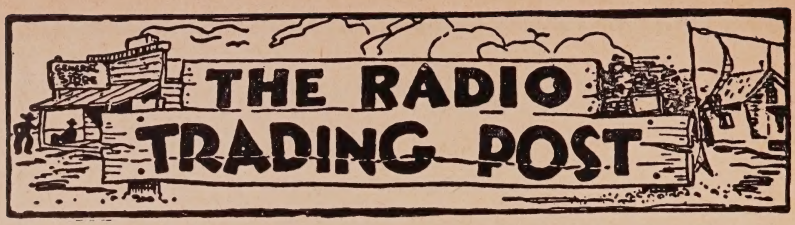

Beam tilted up (15° max.) for determining weather at higher altitudes.
Normal Beam for weather enroute.
Beam tilted down (15° max.) for lower level weather or terrain mapping.
Beam width — 3.8°

This schematic drawing shows how the radar beam can be tilted during flight to observe weather at all altitudes.

ditions at higher or lower altitudes and, of course, at his cruising altitude. The beam itself has a width of 3.8 degrees and can be tilted from normal flight path to 5 degrees, 10 degrees or 15 degrees upward or downward. In a downward tilt the beam also serves as an aid to navigation by mapping terrain variations, lakes, mountains, coast lines, buildings, etc., can be used for "homing" on radar beacons and in "blind flying" or instrument conditions will show up other aircraft.

The unit operates on a frequency of 9214 - 9405 megacycles at 40 kw peak power output with required power of 115 VAC, 300-1000 cps, 700 VA or 115 VAC, 380-420 cps, 200 VA from 27.5 VDC, 25 watts. The entire installation — antenna, transmitter, receiver, amplifier, control box and indicator screen weighs somewhat less than 140 pounds total.

As we mentioned before, you can now look forward to smoother, safer, all-weather flying. For, although the C-D aircraft is now the only non-military transport plane equipped with this new "weather-eye" radar, many regular airlines are ordering these units and should have them installed before long. So, you can see that even in the mystic realm of aviation, "somebody has done something about the weather."



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IF YOU ARE RECEIVING DUPLICATE COPIES FOR WHICH YOU HAVE NO USE, PLEASE ADVISE YOUR LETTER CARRIER STATING — "DUPLICATE — NOT WANTED".

FOR SALE — Like new Heathkit audio amplifier, model A-9A, freq. response, 20 to 20,000 Cps., power output 20 w., 4 inputs, outputs 4,816 500, for $25. Leo Gary, J. H. Keeney & Co., Inc., 2600 West 50th St., Chicago 32, Ill.

SELL OR SWAP — L. n. Regency RC-600 converter and Sutco UHF converter-VHF booster model 22B. Set 17Q strips. Want VTVM, Scope, 6-12 v. dc supply, Heath or Eico kits. Ben W. Meuller, R. 2, No. Tonawanda, N. Y.

WANTED — Cables 8" and 14" for Motorola Auto Radio 409. Have TV Schematics and Service notes to trade for same. Selcraft, Box 394, Spring Valley, N. Y.

SELL OR TRADE — Heath 6 w. amplifier; RCA 17" TV; wireless record changer; Echophone EC-1A radio. E. G. Bartlett, Atlanta, Mo.

FOR SALE — RCA color television home study course, complete $12. L. Matushefske, 2 Elmont Rd., Elmont, N. Y.

SELL OR TRADE — L. n. Police Alarm FM rcvr, $27; Millen VFO used, $20; l. n. BC. 696 and 459A with double rack and shock mounts; heavy duty power supply parts for above Xmitters. Lew Saunders, 229 W. Burnham, Battle Creek, Mich.

SELL OR SWAP — Sonar SRT-120P l. n.; 120 w. Phone and CW all bands, TVI-proof for un-wired or factory-wired Ranger or sell for best cash offer. Guaranteed. Ed Howell, Box 126, Lumberton, N. C.

FOR SALE — Hickok indicating traceometer 156A, l. n.; 2 RF voltmeters, zero-center DC VTVM; AF voltmeter, wattmeter, 5 meters, 5 leads, manual, 12 tubes, $95. Frank York, 114 - 38 196th St., St Albans 12, N. Y.

FOR SALE — Gonset, tri-band converter, plus Sonar 10-meter Xmtr, best offer; Capacitor-Decade Heathkit, model DC-1, $13; GE FM, 42 to 50 mc., best offer. Joseph F. Dineen, 9 Winter Terrace, Westwood, Mass.

FOR SALE — Unused microameter, 2¼" mounting hole, 0 to 150 microamps, DC, made by Gruen Watch Co. George Howerton, 8 South Bedford Ave., Evansville 13, Ind.

SWAP OR SELL — Heath 5" scope; Simpson 303 VTVM; RCA WV-77A VTVM; Heath FM tuner in cabinet; Heath A9A amplifier; Goodman's 12" Hi-Fi spkr. Want E200C Precision sig. gen., Concertone tape recorder. Herbert Piller, 749 Beck St., Bronx, N. Y.

FOR SALE — Supreme service manuals, TV 1951 thru 1954 and Radio 1947 thru 1954. Never used, sell ½ price $15.50 or trade for what have you. Redd's Radio and TV, Box 12, Union Furnace, Ohio.

FOR SALE — Heathkit, completely wired; model AG-7 audio gen., sine and square Wave, 20 cps. to 20 Kc., $28; AG-8 audio gen., sine wave, 20 cps to 2 mcs., $33; V-4A AC-DC vacuum tube voltmeter, $27. Shipping charges extra. J. P. Neil, 1567 College Ave., Palo Alto, Calif.

FOR SALE — Electronic equip., TV manuals (9, 10, 11), Weston 301 meter. John Jordan, 74 Richelieu Terr., Newark, 6, N. J.

WANTED — Books, new or secondhand and journals containing articles on Electronic Digital Computers. State cond. and price. L. Van Zeyl, 17 Maggs St., West Park, Pretoria, South Africa.

FOR SALE — Unused BC-375-E Xmitter, complete; BC-645 Xrcvr.; vibrator power supply PE-157; Wilcox rcvr CW3. Used BC-348 rcvr. converted to 110 v.; complete command set; McElroy Automatic Keyer with practice tape. J. Pietrspouli, 25 Pine St., Port Byron, N. Y.

FOR SALE — Two Eico mod. K 221 VTVM's, good cond. Circular slide rule, free if both purchased. Will sell separately. H. Chu, 110 Mulberry St., N. Y. 13, N. Y.

TRADE — Latest Bessa II, Ikoflex 1A cameras, 4 x 5 enlarger, darkroom equip. for ham transmitting gear, beams, hi-fi gear, etc. Marcel Valois, Box 488, Covington, La.

FOR SALE — BC222 Walkie-Talkie (28 to 52 mc.) telescoping antenna, handset, $25; A200 sig. gen. original carton, $25; Boes 214 Electron beam tube tester, $25; 350 w. modulator VM4 Varimatch, T20D63 Multimatch, $50. Jim Thompson, 2113 Cuyler, Berwyn, Ill.

SWAP — RCA FM-AM sig. gen., model 150, cost $75; and Keystone 8mm movie projector, for 35mm, 300 w. or better, blower cooled projector, for transparencies. Emmet D. Cox, 2912 Madison Ave., Evansville 14, Ind.

SWAP — Complete amateur radio station: Hallicrafter bandswitching Xmitter; low pass filter, National rcvr., band edge spotter, mike. Want equipped house or camp trailer, aluminum or steel boat and motor. Can deliver and pickup within 1,000 miles. R. Bost, Popular Bluff, Mo.

TRADE — 6" swing, 18" between centers, 8 to 96 threads per inch Dunlap metal turning lathe for 5" late popular scope. Also ⅜" Black and Decker elect. drill for typewriter. Want good 7JP4 Pix tube. McKinley's Radio Service, Zebulon, Ga.

FOR SALE — Eighteen vol. Rider's Trouble-shooter Guides, exc. cond., $70. H. Gathercole, 45 Aberdeen Dr., Huntington, L. I., N. Y.

FOR SALE — Capacitors, energy storage Aerovox PX 15D1B, 30 MPD., 2500 v., four for $80 FOB, half list price. A. W. Vincent, 300 West High Ter., Rochester, N. Y.

WANTED — NRI radio and TV course or equal without kits. State price and date of books. Wm. S. Sopko, 12010 Cromwell Ave., Cleveland 20, Ohio.

FOR SALE — Bendix MRT 3B fixed freq. Xmitter and rcvr. for 2 meter mobile operation 6 v. input, Xtal included; model 770 Supreme VOM. Best offer. R. F. Sykes, 206 W. 9th St., Elmira Hgts., N. Y.

SELL — 4 100TH, 1. n. Eimac, $12 ea; 2 Johnson dual variable conds. 151 mmfd. per sec. 7000 v., $7.50 ea.; 15 3E29, make offer; 20 HiVolt. Mica Capacitors, $1.50 ea. or all for $25 FOB. Oscar E. Hager, 102 Wherry Drive, White Sands PG, N. M.

SELL OR TRADE — 2 band, 6 tube Philco table radio, good cond., $9.95; unused 10 w. phono and mike PA, $24.50. Postage extra. Y. Brevda; 55 Hanson Pl., Brooklyn 17, N. Y.

FOR SALE — Three 1mfd, 600 v. cond.; two 2mfd, 600 v. cond.; two 2mfd, 2000 v. cond.; 1-0.1mfd, 5000 v.; two 2mfd, 2500 v.; three 1mfd, 1500 v., COD. S. S. Brody, 211-10 73rd Ave., Bayside, Queens, N. Y.

SELL OR TRADE — 2 Army Walkie Talkies, 10 spare crystals, coils, spare set of tubes, kit, $50; General Radio wavemeter, model 724A; BC454B 3 - 6 mc., A1 shape, $170; Mark II with AC power supply, $30. Nelson Stover, 1357 Hill St., York, Pa.

WANTED — Sprague TO-4, BC-221, Riders TV manuals 8, 10-12. Have 2 TV rcvrs., useful for parts or repair, $10 and $25. Charles E. Spitz, 1420 South Randolph St., Arlington 4, Va.

WANTED — Navy NEA-5 generator. Used, in good cond. Delivered to me in person. John Kozma, 3104 Wilkinson Ave., New York 61, N. Y.

SELL OR TRADE — 75 w., 160 meter Xmtr. and mod. Want VTVM. Ma La Fa Radio Service, Lankin, N. D.

SELL OR TRADE — 78 rpm constant speed governor controlled motor AC; 78 rpm record changer; National xtal calibrator. Want tape recorder. Michael Egnitz, 1125 Kirkpatrick St., No. Braddock, Pa.

TRADE — Complete set of Sams TV folders for good 16 mm camera and projector. Excel Photo Service, 123 South 13th St., Clarinda, Iowa.

SELL — Craftsman 160 amp., 220 AC welder, complete with primary and secondary lines, helmet $85; asst. issues of Electronics, 1933 to 1945. G. F. Gnandt, Wellington, Ohio.

FOR SALE — Eico vacuum tube voltmeter, model 221, used very little, perf. cond., $20. Sid Keitz, 7 St. James Place 161, New York 38, N. Y.

FOR SALE — RCP dynatracer, model 777, used very little, $25 or trade for 17" TM TV in good working cond., or what have you? Rupert Freeman, 2108 33rd Ave., Meridian, Miss.

SELL OR SWAP — For audio equipment: 2 steel filing cabinets, 5x6½x12", hand tachometer 300-4500 rpm, wireless phono. Electronic Service, 4918 Beech St., Hammond, Ind.

WANTED — Movie projector, 21" TV console with cascode tuner, or what have you. Swap 120 bass accordion with case and straps. John Arnold, Box 84, Bluffs, Ill.

FOR SALE — 4,000 ft. GE coaxial cable, 85 ohm; Rider Chanalyst $50; Hickok 610A sweep gen., l. n., $125; Heath sweep gen., A-1 cond., $40; model 164 Dumont scope $30. J. Boehn, 3534 No. Narragansett Ave., Chicago 34, Ill.

WANTED — Schematics and instructions for Solar "Capacitor Analyzer", model CE; and Solar condenser checker, model BQC, "Quick Check with Bridge." State price. John Brinda, Jr., 9233 Cromwell Drive, Pittsburgh 37, Pa.

SELL OR TRADE — Regency UHF converter; Emerson 508 portable; Electro-Voice 3000 booster; '52 Chevrolet radio; Scott marine radio. Want cash, GE ST2A scope, Hickok Videometer, tape recorder. John Pellock, Benld, Ill.

FOR SALE — Precise 300 K scope and RF probe, $72. Mrs. L. Kreisman, 610 West 110th St., New York, N. Y.

WANTED — Riders manuals, 20 and up, also Jackson or Hickok tube checker. Clifford D. Lessig, Radio Service, Milford, N. J., RD 1.

FOR SALE — Riders radio manuals 1 to 14, $40; Riders TV manual, No. 1, $7.50. You pay shipping. O. P. Dickerson Electric, Rockaway, N. J.

FOR SALE — Eico model 425 push-pull scope, factory wired, calibrated, $40; Packard Bell FM tuner, perf., $20; RCA 621 TV set, exc. cond., $20. Local preferred. John C. Bechtler, 23-79 206th St., Bayside 60, N. Y.

FOR SALE — 500 w. Rig with loads of extras, $250. Edward Muska, Box 372, Colonia, N. J.

SWAP — Inverter 250 w., vibrator type, 110 DC in, 110 v. out, 522 receiver converted and hot, without chassis, 654 transceiver, aircraft radio rcvrs. Want ham, photo gear, toys, 16 mm films or what have you? Jack Barns, 321 River Rd., Nutley, N. J.

FOR SALE — SCR522 2-meter receiver (converted) and Xmitter with new 832 final plus complete controls, diagrams and conversion data. S. Silverstein, 226-14 137th Ave., Laurelton 13, N. Y.

WANT — 30 or 40 w. modulation transf., also good wood lathe. Have radio parts, electric water heater, what do you need? Frank H. Carlson, Aledo, Ill.

WANTED — Mark II complete or incomplete, and BC-654. J. Schultz, 85 Livingston St., Brooklyn, N. Y.

WANTED — Co-Ax relay, new or used, cash or swap for power transformers, tubes, surplus vibrator supplies. C. B. Kelley, 7204 Clovernook Ave, Cincinnati 31, Ohio.

FOR SALE — Miller Hi-Fi TRF 5-tube tuner; UTC LS-55; Audak L-17 arm with mag. cart; 12" speaker baffle. Cheap. C. L. Goebel, 221 West 233rd St., Bronx 63, N. Y.

WANTED — BC-375 rotary inductor. Will buy, swap set B&W Balun coils or other parts. Also need 8 mm movie projector. D. M. Frantz, 7056 Noble, Cincinnati 24, Ohio.

FOR SALE — Capitol Radio Engineering Institute correspondence courses. Section 1: $10; Section 2: $50, 1954 edition, original cost $182.75. D. Ketchum, Chaffey College, Ontario, Calif.

SELL OR SWAP — Complete set of 24 textbooks Alexander Hamilton Institute business course, like new. Want tape recorder. A. F. Hegenbart, 326 Westwood, Statesville, N. C.

WANTED — FM Pilotuners, Philco battery sig. gen., BC-604 Army equip., complete and used, CREI correspondence course. Geo. G. Chandler, Box 251, Patchogue, N. Y.

SELL OR SWAP — H. G. Fischer therapeutic machine, BC-645, BC-605, W.E. synchro gen., R14 headphone rcvrs., P47 landing lights with motors. Want tape recorder, power tools, Kingsley imprinter, Leica, 38C and ham gear. James Pittman, Princeton, Ind.

SELL OR TRADE — Excellent NRI Resistor-Condenser-Tester, $20; NRI radio tube tester, $30; Math. for Electricians and Radiomen, by Cooke, $2; set Applied Practical Radio & Television, by Coyne, $12, or what have you? Raymond Lane, 3122 Kenyon Ave., Baltimore 13, Md.

FOR SALE — Precision E-200-C sig. gen., output cable, manual, $50; Simpson 260 VOM, leads and manual, $25, both like new, COD for 24-hour inspection. L. M. Carling, Howard City, Mich.

FOR SALE — Practical Radio Engineering by CREI, 5 binders; Aviation Communication by Midland TV, with binders and Midland TV course, $10 each FOB. Daley Television, Sergeant Bluff, Iowa.

FOR SALE — About 100 used recording tapes, 7" reels, plastic base, 6 reels, $7, 12 reels, $13, postpaid. Send self-addressed stamped envelope for sample. R. Lackner, 2029 Bradley Pl., Chicago 18, Ill.

SELL OR TRADE — Comco 275-C single channel, narrow-band, frequency modulated crystal controlled transmitter-rcvr. for operation in 152-162 mc. band, 6 v. DC, complete with control box, spkr., and cables. Jess Tatum, Kershaw, S. C.

SELL OR TRADE — Beltone Monopac hearing aid; portable record player; 4" reflecting telescope; 3" Pilot TV. Want tape recorder. Theodore Nadeje, 5101-AA 39th Ave., Sunnyside 4, N. Y.

WANTED — 6B5 tube. Will trade tubes for others. Ben's Radio Service, North Tonawanda 2, N. Y.

WANTED — FM 152-162 AC FM, 88-108 AC, recorder disc type. H. Kuell, 18½ Thomas St., Newark, N. J.

WANTED — HY 75A tubes, cash. Edward F. McCarren, 17 Roscoe St., Needham Heights 94, Mass.

WANTED — Two 3AP1, JAN CRT's. Robert O'Neil, RD 3, Ithaca, N. Y.

SELL OR SWAP — Millen Exciter Xmitter, 60 w. input. Want AC communications receiver with bandswitching and bandspread, or make offer . John H. Shaffer, Box 54, Dover, Pa.

SELL OR SWAP — Regency RC-53 UHF converter, l. n., complete with "Bo-Ty" antenna, lightning arrestor, and 50 ft. lead-in wire, for tubes, parts, kits, etc. Luther V. Strader, 1217 Myrtle Ave., Danville, Va.

SWAP — Hickok VTVM, plus field strength meter for 100 w. or better mobile transmitter, complete with power supply and mod. Sam's TV, 188 Main St., Everett, Mass.

FOR SALE — Sprayberry TV course with 7" TV kit, 29 lessons, l. n., $75. Ivory F. Jones, 1207 3rd St., Orange, Texas.

WANTED — Eico tube tester, complete or otherwise. State price and cond., cash. Philip L. Koch, 3534 Connecticut St., St. Louis 18, Mo.

WANTED — Model HT18 Hallicrafter unit. Advise cost and condition. Richard M. Krauss, 1220 Wheatsheaf La., Abington, Pa.

FOR SALE — Browning RV-10, FM tuner, perf. cond., prepaid, $55; Altec-Lansing pre-amp control unit, $50; Altec 600B speaker, sealed carton, unused, $37.50; 250 radio magazines, '46 to present, 25 cents each. N. L. Harper, Charleston, Mo.

TRADE — Radio equip., rcvr., books (send for complete list), for 3 x 5 or 5 x 8 Kelsey. Paul Barry Co., Box 1041, Atlantic City, N. J.

WANTED — Contact with parties interested in like new UHF converters, Ch. 42 strips. K. C. Wolfmeyer, 1120 North Richmond St., Appleton, Wis.

SWAP — Eico: sig. gen., model 320; 221 VTVM; model 145 Multi-signal tracer, all in perf. cond. Want good 35 mm camera. Gary W. Schwindt, 30-28 23rd St., Long Island City 2, N. Y.

SELL OR TRADE — Back issues of: Popular Science, Science and Mechanix, Popular Mechanix, Mechanix Illustrated. Ralph E. Miller, 7 Lorne St., Dorchester 24, Mass.

FOR SALE — Two BC-459A; BC-455; 550-0-550 v., 200 mil power supply, 24 v. fil., transf., plus accumulation of oil filled condensers, transformers, chokes, etc., all in exc. cond. Philip Kogel, 875 East 179th St., Bronx 60, N. Y.

SELL OR TRADE — 8 mm 500 w. movie projector, slightly used, but in perf. cond. Will trade on tape recorder. Charles Nunemacher, Route 4, Freeport, Ill.

TRADE — GE radio model L-660 and DeWald radio, needs slight work; asst. electrolytic capacitors, for tube checker. Louis Tenenbaum, 522 Ocean Avenue, Brooklyn, N. Y.

WANTED — Eico VTVM, model 221, and Eico signal generator, model 320, in any cond. State price. E. J. Durkin, 1465 Third Ave., New York 28, N. Y.

SELL OR TRADE — Capehart M-2AM 4 bands, h. f., $35; Hallicrafters S-38, $25; Hallicrafters S77, $50; Voighlander reflex f3.5, Heliar lens, $35. R. Garcia, 300 West 17th St., New York 11, N. Y.

FOR SALE — Simpson field strength meter, model 488, A-1 cond., $65. G. W. Webb, 3850 Loma Alta Dr., San Diego 15, Calif.

SELL OR TRADE — Back issues: Radio & Television News, Radio Electronics, Flying, Skyways, Mechanix Illustrated, Popular Science, others. Want Radio-TV books of theory and servicing. Wm. H. Steffey, Route 5, Staunton, Va.

WANTED — Riders Manuals above 15 and some Sams Photofacts, above 100. State price. John C. Baxter, 1122 North Geyer Rd., Kirkwood 22, Mo.

FOR SALE — Pair battery-operated telephone handsets, $5; J-38 sending key, Hi-Fi buzzer and battery, $2.50; Modern Radio Servicing, by Ghirardi, $1.25; sig. tracer, with eye tube and speaker, $10; 3-way portable Firestone radio, $10. Robert Gelnett, R. D. 2, Liverpool, Pa.

FOR SALE — Riders Manuals, vols. 1, 2, 3, 5, $3.50 each, or all for $12. G. Epstein, 200 - 27 46th Ave., Bayside 61, N. Y.

SELL OR SWAP — Lysco 600 TVI'd Xmtr with clampmaster modulator, connecting plugs and cables. Want late model tube tester, signal generator. Local preferred. H. B. Bodian, 30 East 60th St., New York 22, N. Y.

SELL — Stancor Xformers, output A3304, power P-6011 and 6012, $3 each; Eico battery eliminator, $20; R23/ARC-5 rcvr., with dynamotor unmodified, $20; PE101C modified mechanically, $4. All plus postage. Need rcvr., HQ-129X, etc. M. Marshall, 455 Washington Avenue, Dumont, N. J.

SELL OR SWAP — Dynamotor, like new, 27 v. input, 255 v.—.060 A. output. Want VTVM. B. Swetzoff, 149 Intervale St., Dorchester, Mass.

TRADE — Battery eliminator in good shape for "Treasure Finder." Want Silvertone table model 3361. George Mashek, Marissa, Ill.

TRADE — 3 receivers: BC-453B 190-550 kc., BC-454B 3-6 mc., BC-455B 6-9.1 mc.; FT 220 rack, radio range filter, 110 AC power supply, headphones, completely converted, connect antenna and plug-in. Want good hand gun. George Timmins, Box 53, Bloomingdale, Ill.

FOR SALE — RCA 155A 3" cathode ray oscilloscope, includes 12-page operating and maintenance manual, exc. cond., $45 plus shipping. W. Levine, 67-22 218th St., Bayside 64, N. Y.

WANTED — Late model Hickok TV service instruments, cash or trade. Lukelectric Supply, Baltic, Ohio.

TRADE — GE 10" TV set in good operating cond., toward tape recorder or 8 mm movie projector. B. Kendis, 10 Forest Grove, Apt. 16, Daly City, Calif.

FOR SALE — 16" TV chassis; 7" Hallicrafter TV; new RCA home study TV color course. Best offer for part or all. H. Bell, 3917 Ely Ave., New York 66, N. Y.

FOR SALE — Waterman scope, S-10-B, $25; sweep gen. app. Electronic 300A, $20; Hickok Crosshatch gen., model 620, $35. Joseph Barry, 105 - 08 133rd St., Richmond Hill, Queens, N. Y.

FOR SALE — Alliance antenna rotor, model ATR with control box, used but like new, $15 prepaid. M. Ferenc, 43 Hudson St., Garfield, N. J.

SELL OR TRADE — NRI course in radio fundamentals; Heath electronic switch, model S-1, $14.50; Sams Photofact TV course; Servicing TV Receivers, by Philco; book on radio-TV, by Coyne, all l. n., $6 plus postage. Lowe E. Smith, Route 1, Trion, Ga.

FOR SALE — Riders radio manuals, 1 thru 14, exc. cond., $50 FOB. Walt Kalem, 12116 Lumpkin, Detroit 12, Mich.

TRADE — Hi-Fi amplifier, 20 w., for Hi-Fi speaker. Want Altec 604C. Thomas C. Ravesi, 99 Rockridge Rd., Waltham 54, Mass.

SELL OR TRADE — Univex P-8 8 mm movie projector, for automatic C-W key, Q5'er, frequency meter, or ham equip. Bob Weggel, Route 2, Rhinelander, Wis.

SWAP — Dumont 12" table model TV with radio, needs some repairs; two auto radios; 18th Edition Radiomaster. All FOB. Want Sams Photofacts or test equip. Ray Arendt, 207 East Amherst St., Buffalo 14, N. Y.

WANTED — Hewlett-Packard model 200 CD oscillator. State price and cond. Leslie Gnagy, 12223 Lock Ave., Cleveland 8, Ohio.

FOR SALE — Riders radio manuals, vols. 1-23, good cond.; Riders record-player manual, and Riders "Cathode Ray Tube at Work," all for $125. Mrs. Darrell E. Flora, 205 South Ford St., Hutchinson, Kan.

TRADE — Zenith portable radio, AC and DC, $49.50; disc recorder cutting head and playback, less amplifier, for 4 x 5 flash camera and good 16 mm sound projector. Emory Corron, 4096 Redonda Lane, Dayton 6, Ohio.

WANTED — Riders manuals, 8 and 14. Will pay $4 each if complete and clean cond. J. Bartlett, 261 Whitman St., New Bedford, Mass.

FOR SALE — Heath: TS-3 TV alignment sig. gen.; SG-6 sig. gen.; T-2 sig. tracer; V-6 vacuum tube voltmeter; 3" DTI scope; power supply; DTI multimeter, 30,000 high voltage probe. All perfect. Stanley Bombka, 8107 North Odell Ave., Niles 31, Ill.

SWAP — Back numbers Radio News from Jan., '37 to Dec., '45; books on finger-printing, for test equip., and books on radio, TV. Martin Feldman, 265 Cabrini Blvd., New York 40, N. Y.

FOR SALE — Zenith transoceanic portable R600L, with batteries and operating guide, $85. John F. Ehrlich, 281 Schaffer St., Brooklyn, N. Y.

FOR SALE — A-200 sig. gen., l. n., $16; C-D Analyzer, model BF-50, used very little, $25; Riders 1 to 12, perf. cond., $60. Frank Cresswell, 48 College Ave., Tarrytown, N. Y.

FOR SALE — Older type tubes, in orig. cartons: G4S, G6Z5, O1A, 199, 200-A, 32,55S, 89, 2A7, 6A6, 6C8G, 1A5GT, 1A6, 1C5GT, 1H5GT, 1P5GT, 1Q5GT, 1T5GT, 6B8. Write for price. Turner Radio & TV, 2019 Sherman St., Anderson, Ind.

FOR SALE — Surplus transmitting and receiving tubes, Xformers, chokes, filter condensers, BC-696, BC-459, BC-455, dynamotors, misc. ham gear. Write for details and prices. A. J. Arnold, 2028 Crockett St., Amarillo, Tex.

FOR SALE — 6 volt Heathkit battery eliminator, like new, $20. Charles R. Beckwith, 1734 South Liberty Avenue, Alliance, Ohio.

TRADE — Riders vols. 1 to 5, 6 to 21 plus PA volume, for rifles or handguns, sporting type. George's Appliances, Box 464, Uleta, Fla.

SELL OR TRADE — Beautiful Federal commercial radio-telephone full kilowatt plus, 3 slim 6 ft. cabinets, modulator, power supply, RF units. Uses 450TH tubes in modulator and output stages, $595, or trade for Collins 75A3. C. B. Hempell, Box 2098, Cheyenne, Wyo.

SELL — Complete working mobile station: Elmac A-54, 10-20-80; Gonset Tri-band converter, noise clipper, Eicor dynamotor, Master A 11-band coil, antenna and mounts, cabling, fuses, mike, control relays, etc. Over $400 worth for $200. L. E. Jones, 1006 Hoyne St., Streator, Ill.

WANTED — Leece-Neville Altenator, 100 amp. preferred, complete with regulator and rectifier, to be used on '52 Ford. Trade for Contax 1 or Gonset Super-six. Richard Dundon, 16606 6th Avenue SW, Seattle 66, Wash.

FOR SALE — DeForest Training Radio & TV home study course. Best cash offer or trade for HO model train equip. Frank Dawson, Box 337, Republic, Mich.

WANTED — Model BC-323 VHF frequency meter or similar surplus model. J. D. Nix, 3430 Orchard St., Hapeville, Ga.

FOR SALE — Narco T-3 Omni Simulator; also complete set-up for light aircraft radio servicing, including parts and instruction manuals. Need model 80 sig. gen. W. J. Stange, 1104 Newberry Ave., La Grange Park, Ill.

FOR SALE — 15 w. PA system, with mike with floor stand, phonograph with 3 speeds, two 8" PM speakers in wall baffles. First $75 takes all. Joe Caruso, 731 North Green St., Detroit 9, Mich.

WANTED — For cash, Sams Photofact folders 231 to date, all folders should be complete. State if in binders, cond., and price. Earl W. Wells, 223 North Philadelphia St., Shawnee, Okla.

FOR SALE — Riders manuals vols. 7, 9, 11, 12, 14, $30; Gernsback 1 to 5, $5; Philco, RCA, Zenith, Mallory, Emerson, Supreme manuals, from $.50 to $2.50; Supreme model 385D tube tester and analyzer, $35. All like new. Ed Tischler, 58 Carey Ave., Wilkes-Barre, Pa.

WANTED — Power and filament transformer, 110 v., 60 cy., for Signal Corps Combination tester, model 104 of Test Set I-56-D. R. V. Nelson, 938 South Vine, Denver 9, Colo.

FOR SALE — Heathkit Hi-Fi pre-amp., model WAP-1 and GE record compensator, model A1-900, 1. n. Any offer above $15. Anthony J. Tiso, 15 Pease St., Mt. Vernon, N. Y.

WANTED — Radio-Electronic-Engineering edition of "Radio and Television News" from May, 1951 thru Dec., 1953. Have transformers for trade. E. Dudis, 273 North American Blvd., Vandalia, Ohio.

SELL OR TRADE — Masco TV booster, model MTB-13X; Kodak 35 camera, for tape recorder, cash, or what have you? S. T. Bodo, Route 1. Northampton, Pa.

WANTED — State price, issue No., and condition: Electronics, T. B. Brown; Recording and Reproduction of Sound, Oliver Read; also books covering short-wave techniques. Rudolph Chlupsa, 45-56 189th St., Flushing 58, N. Y.

SWAP — Thordarson plate transformer, 3120-2500 volt AC, 300 ma. ham Xtals, BC 459-696-522 (SCR). Want plate transformer, 300 ma., 800-750-600 v. DC, modulation trans., UTC S21, driver UTC S8, S9, S10; Transmitting tubes. Cecil Van Buren, Star Route, Guymon, Okla.

WANTED — Xmtr., rcvr., and accessories on 27.255 mc. citizenship band. Will buy or trade power tools. J. A. Moore, 710 Keith Bldg., Cleveland 15, Ohio.

SWAP — National HRO-5TA1 receiver for Bell & Howell sound projector, model 179 or 185. N. Crane, 1100 Bryant St., Rahway, N. J.

SELL OR SWAP — Magnetos, switches, varistors, cradle phones with butterfly switch used in Army BD71 and BD72 switchboards, exc. cond. Can use old handbooks or other ham gear. Marvin Gurlin, 111 White Horse Pike, Audubon 6, N. J.

FOR SALE — Millen 92101 R-9'er with 10 and 20 meter coils, $10. Bob Feigenbaum, 708 West 171st St., New York 32, N. Y.

FOR SALE — Riders manuals 8 thru 22, complete with index, exc. cond., $190. F. W. Small, Beulah, Mich.

SELL OR SWAP — CREI Advanced Radio Engineering course, 1947 copyright, 56 lessons, complete in binders; ICS Radio Operating course, copyright 1943, 30 lessons, complete, binders. John Moran, Jr., 30 Longport Ave., Ocean Gate, N. J.

FOR SALE — Like new Navy ARB rcvr., 195 kc. — 9.05 mc., complete with three control boxes, plugs, cable, dynamotor, $50. Leith Mangels, 154 Franklin Tpk., Hohokus, N. J.

TRADE OR SELL — 1/4 hp AC and 1/4 hp DC motors, 300 v. vibrapack, 20 w. amplifier. Need grid dipper, receiver. Stanley Zuchora, 2748 Meade Street, Detroit 12, Mich.

FOR SALE — 30-40 mc. AM rcvrs., crystal controlled, with sqelch, also Monitor radio 30-40 mc., FM, 152-174 mc. rcvrs. R. Spera, 37 - 10 33rd St., Long Island City 1, N. Y.

TRADE — Extensive miniature railroad equip., for good comm. rcvr., or good transmitter, i.e., Johnson Xmtr. 1 or 2 or Ranger. Fred Green, Box 895, Johnson City, Tenn.

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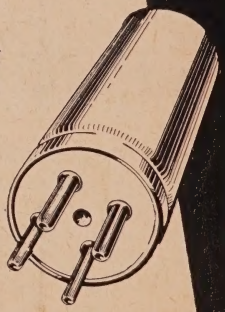

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